APPENDIX J
Hydrogeologic Investigations of the Floridan Aquifer System

HYDROGEOLOGIC INVESTIGATION OF THE FLORIDAN AQUIFER SYSTEM, INTERCESSION CITY, OSCEOLA COUNTY, FLORIDA

Executive Summary

The *2000 Kissimmee Basin Water Supply Plan* (KB Plan) was the first look at the long-term water use conditions for areas located north of Lake Okeechobee within the South Florida Water Management District (SFWMD or District).

The findings of the KB Plan suggest the groundwater supplies in Osceola County area may not be sufficient to meet the 2020 (1-in-10 drought year) water supply needs. The continued use of the Upper Floridan Aquifer (UFA) may affect wetlands, reduce spring flow and possibly be a factor in the formation of sinkholes in this area. However, these conclusions are predicated on a limited amount of geologic and hydrologic information in this region. In particular, information about the Lower Floridan Aquifer is very limited.

This report documents the results of three Floridan Aquifer wells constructed and tested under the direction of the SFWMD. The Intercession City site was selected to augment existing hydrogeologic data and to provide broad, spatial coverage within the Kissimmee Basin Planning Area.

The highest ranked recommendation of the KB Plan is to gather more hydrogeologic information on the Floridan Aquifer System (FAS) to better resolve the uncertainty of future water use affects. The wells will supply information needed to characterize the water supply potential of the FAS and for use in development of a groundwater flow model, which will support planning and regulatory decisions.

The FAS test site is near Intercession City in northwest Osceola County on SFWMD-owned property known as the Upper Lakes Watershed Property (**Figure 1**). The wells are located in the northeast quadrant of Section 3 of Township 26 South, Range 28 East. Land surface was surveyed at 68.2 feet relative to the National Geodetic Vertical Datum (NGVD) of 1929.

The scope of the investigation consisted of constructing and testing three FAS wells. The first well identified as OSF-97 was drilled to a total depth of 2,480 feet below land surface (bls). The contractor built a telescoping type well in various stages, completing it into three distinct hydrogeologic zones within the FAS. A single-zone monitor well identified as OSF-100 was constructed into the uppermost portion of the FAS. A dual-zone production well identified as IC_PW located 340 feet north of the FAS monitor wells was constructed to facilitate aquifer testing of the upper and lower portion of the FAS.

The SFWMD provided oversight during all well drilling, construction and testing. The Diversified Drilling Corporation (DDC), a Tampa based corporation, was responsible for all drilling, well construction and testing services at the Intercession City site under SFWMD Contract C-12356. This project was completed on schedule, costing $720,000.

The main findings of the exploratory drilling and testing program at this site are as follows:

- The top of the FAS as defined by the Southeastern Geological Society AdHoc Committee on Florida Hydrostratigraphic Unit Definition (1986) was identified at a depth of approximately 110 feet below land surface.
- Lithologic and geophysical logs, specific capacity and aquifer performance test results indicate moderate production capacity in Zone A of the UFA, good production capacity in Zone B of the UFA and excellent production capacity in the Lower Floridan Aquifer (LFA).
- Water quality data from packer tests and completed monitor zones indicate that chloride and total dissolved solids in the UFA waters meet potable drinking water standards.
- The base of the Underground Source of Drinking Water, those waters having TDS concentrations less than 10,000 mg/L, occurs at an approximate depth of 2,250 feet bls.
- Zone A of the UFA from 110 to 260 feet bls yielded a transmissivity of 115,000 gallons per day per foot of aquifer (gpd/ft), storage coefficient of 2.2×10^{-5}, an r/B value of 0.12 and a leakance value of 1.43×10^{-2} gpd/ft^3.
- Zone B of the UFA 360 to 860 feet bls yielded a transmissivity of 510,000 gpd/ft, storage coefficient of 6.1×10^{-5}, an r/B value of 0.07 and a leakance value of 2.16×10^{-2} gpd/ft^3.
- A productive horizon in LFA from 1,210 to 1,500 feet bls yielded a transmissivity of 1,500,000 gpd/ft storage coefficient of 1.2×10^{-5}, an r/B value of 0.007 and a leakance value of 6.36×10^{-4} gpd/ft^3.
- The average measured hydraulic heads for the FAS monitoring intervals are as follows:

  66.58 feet above mean sea level for the 370 to 860 feet bls monitor interval,

  54.13 feet above mean sea level for the 1,220 to 1,490 feet bls monitor interval,

  53.00 feet above mean sea level for the 2,000 to 2097 feet bls monitor interval.
- Water levels in the FAS respond to external stresses, such as tidal loading and barometric pressure variations.

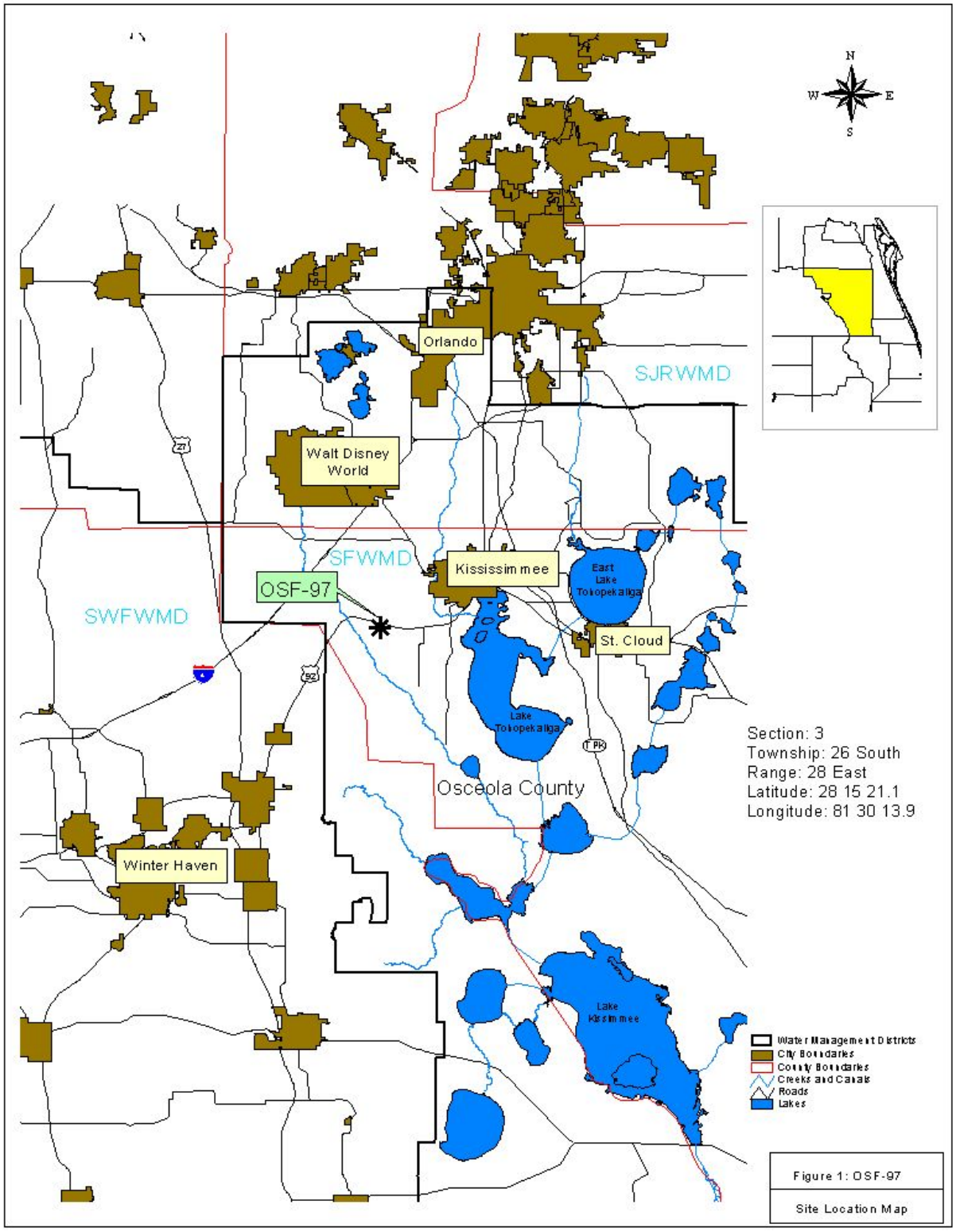

Figure 1. Intercession City FAS Test Well Location Map.

HYDROGEOLOGIC INVESTIGATION OF THE FLORIDAN AQUIFER SYSTEM, REEDY CREEK IMPROVEMENT DISTRICT, ORANGE COUNTY, FLORIDA

Executive Summary

The *2000 Kissimmee Basin Water Supply Plan* (KB Plan) was the first look at the long-term water use conditions for areas located north of Lake Okeechobee within the South Florida Water Management District (SFWMD or District).

The findings of the KB Plan suggest that the groundwater supplies in Osceola County area may not be sufficient to meet the 2020 (1-in-10 drought year) water supply needs. The continued use of the Upper Floridan Aquifer (UFA) may affect wetlands, reduce spring flow and possibly be a factor in the formation of sinkholes in this area. However, these conclusions are predicated on a limited amount of geologic and hydrologic information in this region. In particular, information regarding the Lower Floridan Aquifer (LFA) is very limited.

The highest ranked recommendation of the KB Plan is to gather additional hydrogeologic information on the Floridan Aquifer System (FAS) to better resolve the uncertainty of future water use affects. Towards that end, three FAS exploratory sites were completed in the Kissimmee Basin Planning Area over the past five years. This report summarizes results from one of those sites located at the Reedy Creek Improvement District (RCID). This well will supply information needed to characterize the water supply potential of the LFA and for use in the development of a groundwater flow model, which will support future planning and regulatory decisions.

The FAS test site described in this report is located in southwest Orange County on RCID property (**Figure 2**). The test/monitor well is located in the southeast quadrant of Section 23 of Township 24 South, Range 27 East. The geographic coordinates of the RCID test/monitor well are 28° 22’43.7” N latitude and 81° 35’ 15.9” W longitude relative to the North American Datum (NAD) of 1983. Land surface was surveyed at 68.2 feet relative to the National Geodetic Vertical Datum (NGVD) of 1929. The RCID site was selected to augment existing hydrogeologic data and to provide broad, spatial coverage within the Kissimmee Basin Planning Area.

The scope of the investigation consisted of constructing and testing a LFA well, constructed to Florida Department of Environmental Class V, Group 8 well standards. The well identified as ORF-60 was drilled to a total depth of 2,100 feet below land surface (bls). The contractor constructed a telescoping type well in various stages, completing it into a distinct hydrogeologic zone within the LFA from 1,160 to 1,280 feet bls.

The SFWMD provided oversight during all well drilling, construction and testing operations. The Diversified Drilling Corporation (DDC) was responsible for all drilling, well construction and testing services at the RCID site. The cost of this project ($375,000) was mutually shared by RCID, SFWMD and Orange County Utilities.

The main findings of the exploratory drilling and testing program at this site are as follows:

- The top of the FAS as defined by the Southeastern Geological Society AdHoc Committee on Florida Hydrostratigraphic Unit Definition (1986) was identified at a depth of approximately 80 feet below land surface (bls).
- A 10-inch inner diameter exploratory well was successfully constructed and tested at the RCID site in accordance with FDEP Class V, Group 8, well standards.
- Lithologic and geophysical logs, specific capacity and aquifer performance test results indicate moderate production capacity in Zone A of the UFA (80 to 250 feet bls) and very good production capacity in Zone B of the UFA (300 to 740 feet bls).
- Water quality data from 220 to 715 feet bls indicate that chloride and total dissolved solids in the UFA waters meet potable drinking water standards with chloride and total dissolved solids concentrations of five and 134 milligrams per liter, respectively.
- Lithologic information and geophysical logs obtained from OSF-60 indicates that low porosity/permeability, poorly indurated grainstones and moderately to well indurated, wackestones and crystalline dolostones occur from 740 to 1,160 feet bls, These low permeable sediments act as a confining unit that effectively isolates the UFA from the LFA.
- Lithologic and geophysical logs and specific capacity test results indicate very good production capacity of the LFA “Zone A” from 1,170 to 1,280 feet bls. This zone yielded a specific capacity value of 116 gpm/foot of drawdown at pump rate of 2,210 gpm with a calculated transmissivity of 232,000 gpd/ft.
- Lithologic data, geophysical logs and packer test results indicate good production capacity of the LFA “Zone B” from 1,860 to 1,970 feet bls. This zone yielded a specific capacity value of 116 gpm/foot of drawdown with chloride and total dissolved solids concentrations of seven and 148 milligrams per liter (mg/L), respectively.
- Composite water quality sampling of ORF-60 (1,170 to 1,280 feet bls) indicate that chloride and total dissolved solids meet potable drinking water standards with chloride and total dissolved solids concentrations of eight and a 160 milligrams per liter, respectively.

- Lithologic data and production-type logs (e.g. flow, temperature logs) indicate very good production from flow zones between 1,170 and 1,195 feet bls and 1,215 to 1,270 feet bls. Below 1,270 feet bls, the productive capacity is limited (as indicated by the fluid-type logs) suggesting lower permeable—semi-confining units near the base of the monitor zone.
- The base of the Underground Source of Drinking Water, those waters having TDS concentrations less than 10,000 mg/L, was not encountered at the total depth of 2,100 feet bls.

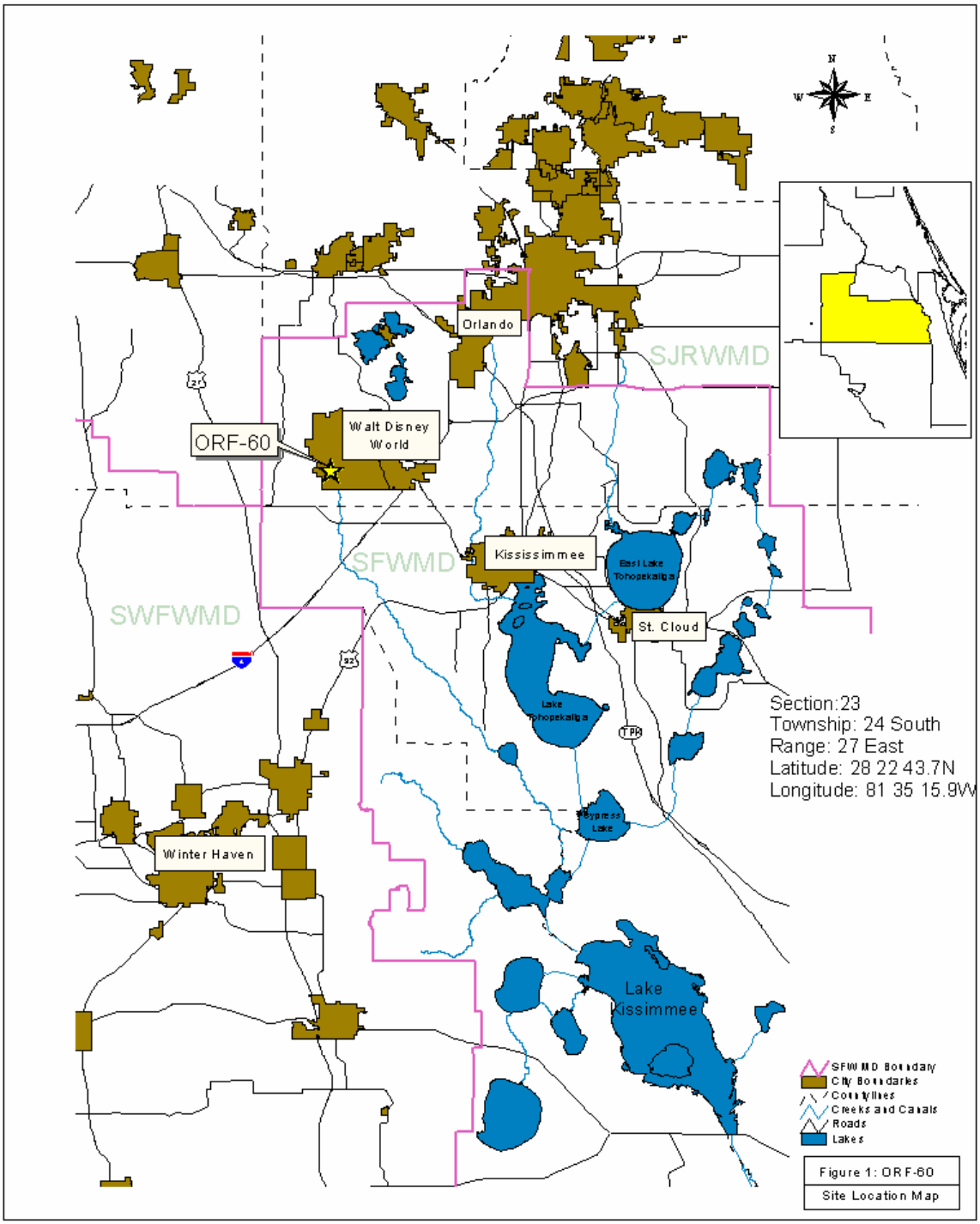

Figure 2. Reedy Creek Improvement District FAS Test Well Location Map.

HYDROGEOLOGIC INVESTIGATION OF THE FLORIDAN AQUIFER SYSTEM, R.D. KEENE COUNTY PARK, ORANGE COUNTY, FLORIDA

Executive Summary

The Kissimmee Basin Planning Area covers approximately 3,500 square miles, includes portions of Orange, Osceola, Polk, Highlands, Okeechobee and Glades counties and shares common boundaries with the St. Johns River Water Management District and the Southwest Florida Water Management District. The *2000 Kissimmee Basin Water Supply Plan* (KB Plan) examined the long-term water use conditions for areas located north of Lake Okeechobee within the South Florida Water Management District (SFWMD or District).

The findings of the 2000 KB Plan suggest that the groundwater supplies in portions of Orange, Osceola and Polk counties may not be sufficient to meet the 2020 (1-in-10 drought year) water supply needs. In the Orange, Osceola and Polk County area, the continued use of the Upper Florida Aquifer (UFA) has been projected to contribute to possible harm to wetlands, reduction in spring flow and may be a factor in the formation of sinkholes. These conclusions however, were predicated on a limited amount of geologic and hydrologic information in the region. In particular, information regarding the interactions between the Surficial Aquifer and UFA is very limited.

A priority recommendation in the KB Plan was to gather additional hydrologic information to better address the uncertainty of the future water use of the UFA and their impact to wetlands and surface water. Towards that end, three Floridan Aquifer System (FAS) exploratory sites were completed in the Kissimmee Basin Planning Area over the past five years. This report summarizes results from one of those sites located at the R.D. Keene County Park in Orange County.

The objective of this work was to construct and test a series of wells that will support the KB Plan and its recommendations. Data collected from the testing and monitoring of the wells at this site will be instrumental in revising the current groundwater model and evaluation of wetland impact constraints. The R.D Keene site is presently part of SFWMD's long-term water level monitoring network.

The test site described in this report is located in western Orange County within the R.D. Keene County Park (**Figure 3**). Specifically, the test site is located near the Town of Windermere in the northeast quadrant of Section 20, Range 28 East and Township 23 South. Land surface elevation was surveyed at 106.1 feet relative to the National Geodetic Vertical Datum (NGVD) of 1929.

Site preparation and equipment mobilization at the project site began February 20, 2003. The contractor constructed two UFA wells, and three shallow (32 to 92 feet bls) monitor wells to determine the degree of connection between the Surficial Aquifer System (SAS) and the UFA. The UFA wells consisted of one 14-inch diameter test- production well and one 6-inch diameter observation well (identified as ORF-61). In addition, two 2-inch diameter PVC monitor wells were constructed; one completed into the Hawthorn Group (upper confining unit and identified as ORH-1) and one into the SAS (identified as ORS-3) with a corresponding 6-inch diameter test-production well completed in the SAS.

The SFWMD provided technical guidance and oversight of all well construction and testing operations. The Diversified Drilling Corporation (DDC) was responsible for well construction and testing services associated with this project. Daily data collection activities and construction oversight were facilitated by Universal Engineering Sciences (UES). This project was completed on June 10, 2003 at a cost of $225,000.

The main findings of the exploratory drilling and testing program at this site are as follows:

- The top of the FAS was identified at 106 feet below land surface as defined as the first occurrence of vertically persistent, permeable and consolidated, carbonate unit (Tibbals 1990).
- Lithologic data, geophysical logs and aquifer performance test results indicate moderate to good production capacity in UFA.
- Water quality data from the completed monitor wells indicate that chloride and total dissolved solids concentrations in the Surficial Aquifer and UFA meet potable drinking water standards.
- The SAS hydraulic test results yielded a transmissivity of 170 gallons per day per foot of aquifer (gpd/ft) and a dimensionless storativity value of 5.75 x 10 -2.
- The Hawthorn Group (intermediate confining unit) yielded a hydraulic conductivity of 0.038 ft/day.
- Hydraulic testing of the UFA, which included the both Zones A & B yielded a transmissivity of 300,000 gpd/ft, a storage coefficient of 2.40 x 10 -3, a dimensionless r/B value of 0.04 with a calculated leakance value of 7.50 x 10 -2 gpd/ft3.
- Hydraulic test results indicate moderate connectivity between SAS and UFA.

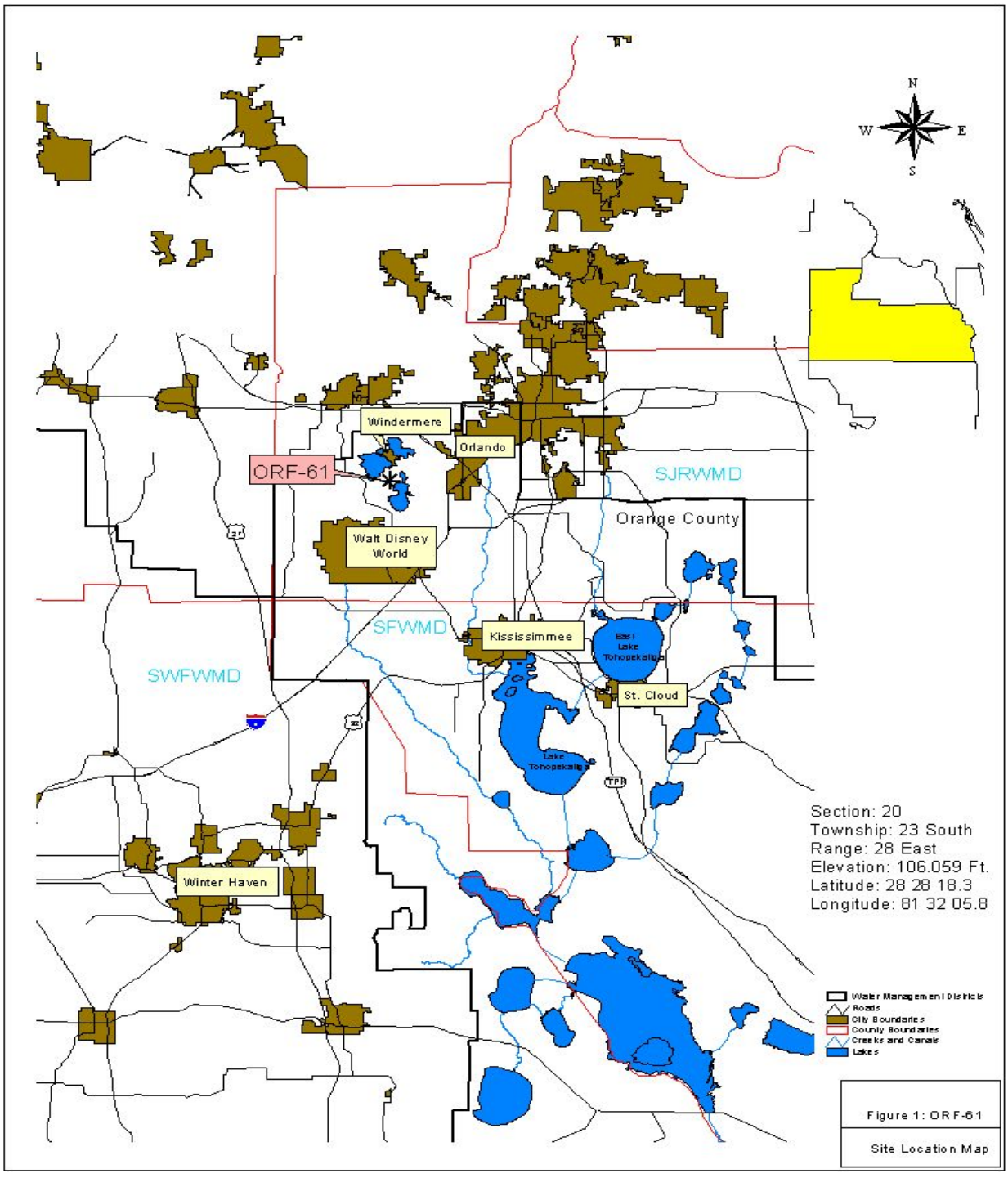

Figure 3. R.D. Keene County Park FAS Test Well Location Map.

REFERENCES CITED

Bennett, M.W. and E. Rectenwald. 2003. *Preliminary Report: HydroGeologic Investigation of the Floridan Aquifer System, Intercession City, Osceola County, Florida.* Water Supply Department, SFWMD, West Palm Beach, FL.

Bennett, M.W. and E. Rectenwald. 2003. *Preliminary Report: HydroGeologic Investigation of the Floridan Aquifer System, Reedy Creek Improvement District, Orange County, Florida.* Water Supply Department, SFWMD, West Palm Beach, FL.

Bennett, M.W., S. Anderson and E. Rectenwald. *2004. Preliminary Report: HydroGeologic Investigation of the Floridan Aquifer System, R.D. Keene County Park, Orange County, Florida.* Water Supply Department, SFWMD, West Palm Beach, FL.